ESnet

ENERGY SCIENCES NETWORK

ICNWG, Replication/Versioning, and Data Transfer Working Team

Eli Dart – ESnet

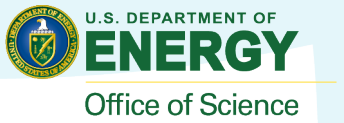
Lukasz Lacinski – Globus

Stephan Kindermann – DKRZ

2018 ESGF meeting

San Francisco, CA

December 6, 2017



Outline

- Year In Review
- Current Status
- Performance Capabilities of DTN Clusters

ESnet

Year In Review

- Plan:
  - Deploy a test federation at multiple sites
  - Set up data replication within the test federation using Synda
  - Use what we learned to deploy replication in production
- What we did:
  - Deploy test federation: ✔
    - CEDA, DKRZ, IPSL, LLNL, NCI
  - Set up data replication within the test federation using Synda: ✔
  - Use what we learned to deploy replication in production: X
    - Still a work in progress

ESnet

Current Status

- Scope reduction: publication of replicas
  - Automatic publication of replicated data out of scope
  - Different sites have different needs/policies
  - Not conflating this with getting the data there
- Different sites in various states of readiness for production deployment
  - Several sites have dedicated DTNs
  - Waiting on integration, final finishing touches
  - Will require some focused effort
- Performance is still low
  - Need some focused work here

ESnet

Data Transfers Between Large Sites

- Replication involves moving large amounts of data between sites
- Large-scale downloads for analysis are similar
- Both involve transferring large data sets between large storage systems
  - Not somebody's laptop
  - Tier1 ESGF nodes
  - HPC facilities
  - Support server-side analysis of non-local data sets
  - Support large-scale users who need data for non-canned analyses
- Both download methods use the same data service
  - Follow-on to yesterday's conversation: harden and improve performance of download capability

ESnet

Making the list of things to do

- I like the idea of building a solid platform of core services
- Short term action planning: address short term actions to support CMIP6 initially
  - Improve single stream bandwidths to CMIP6 data servers from DTNs
  - Configuration issues at sites
  - Data publication to support download via DTNs
    - Data publication using globus endpoint
- Long term action planning: what has to be prepared to support CMIP6+ in the future
  - Exploit Globus Transfer in replication pipeline
  - Expand DTN deployments to match data scale

ESnet

NCAR RDA Data Portal

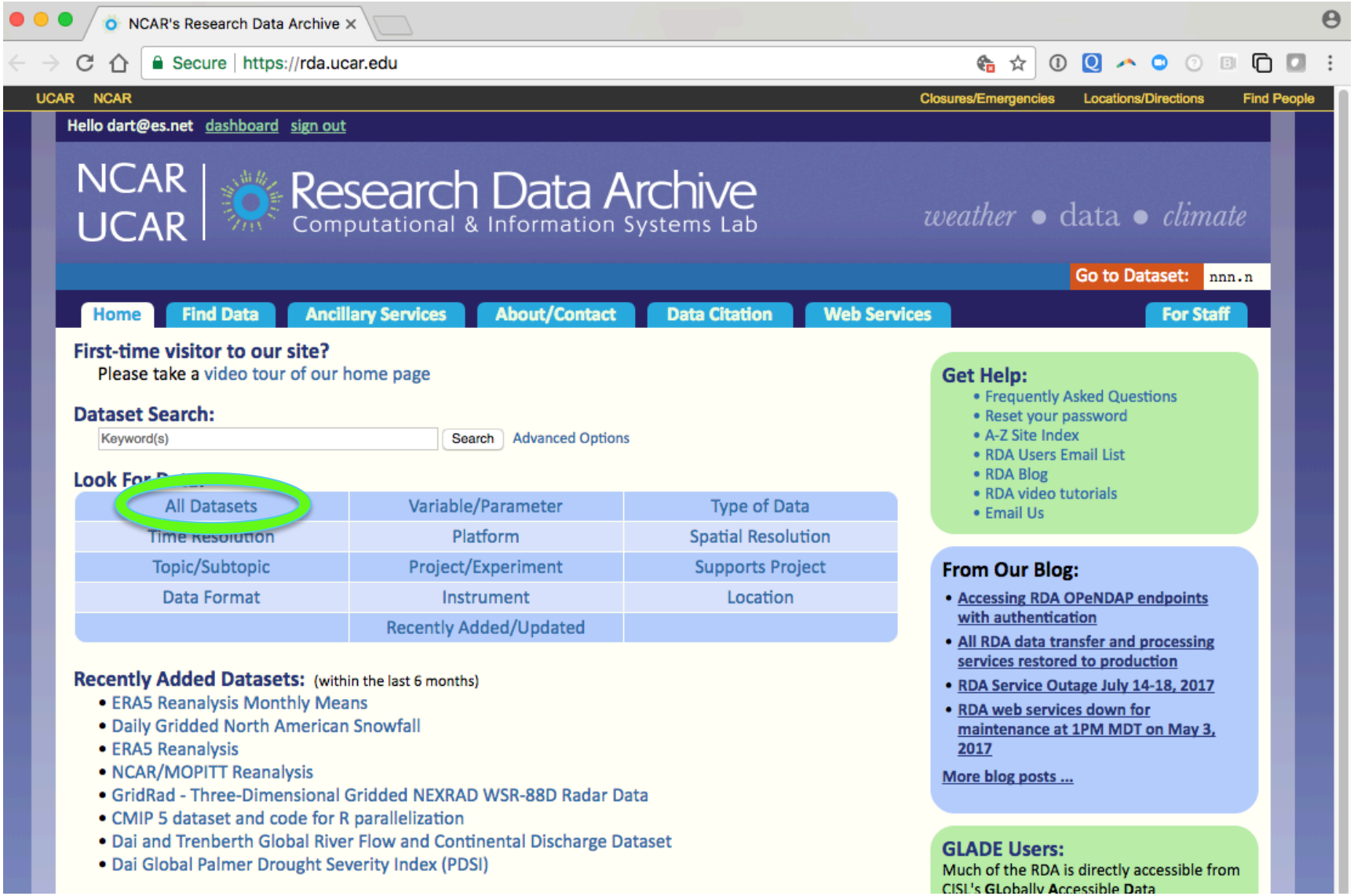
- Let's say I have a nice compute allocation at NERSC – climate science
- Let's say I need some data from NCAR for my project

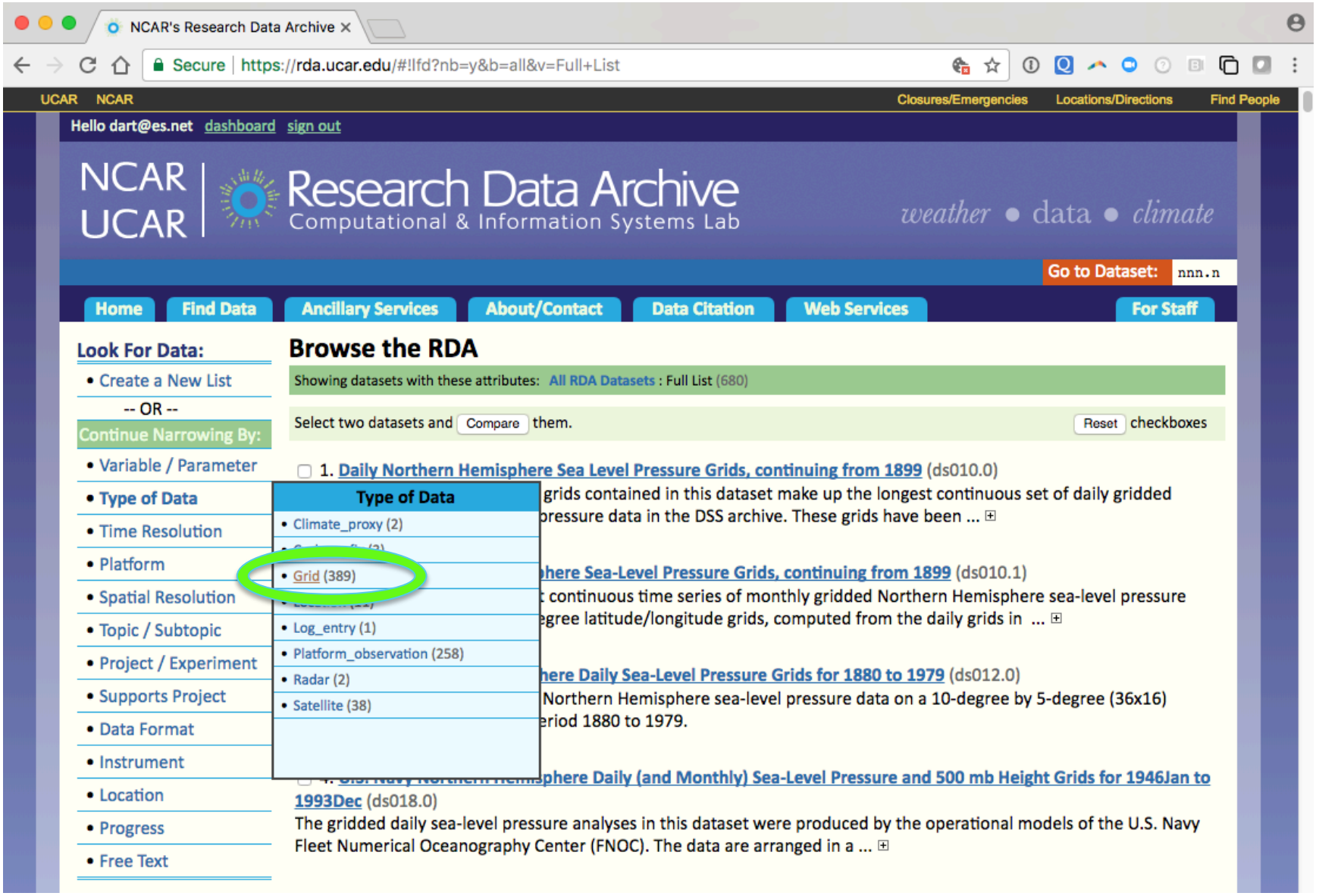
- https://rda.ucar.edu/

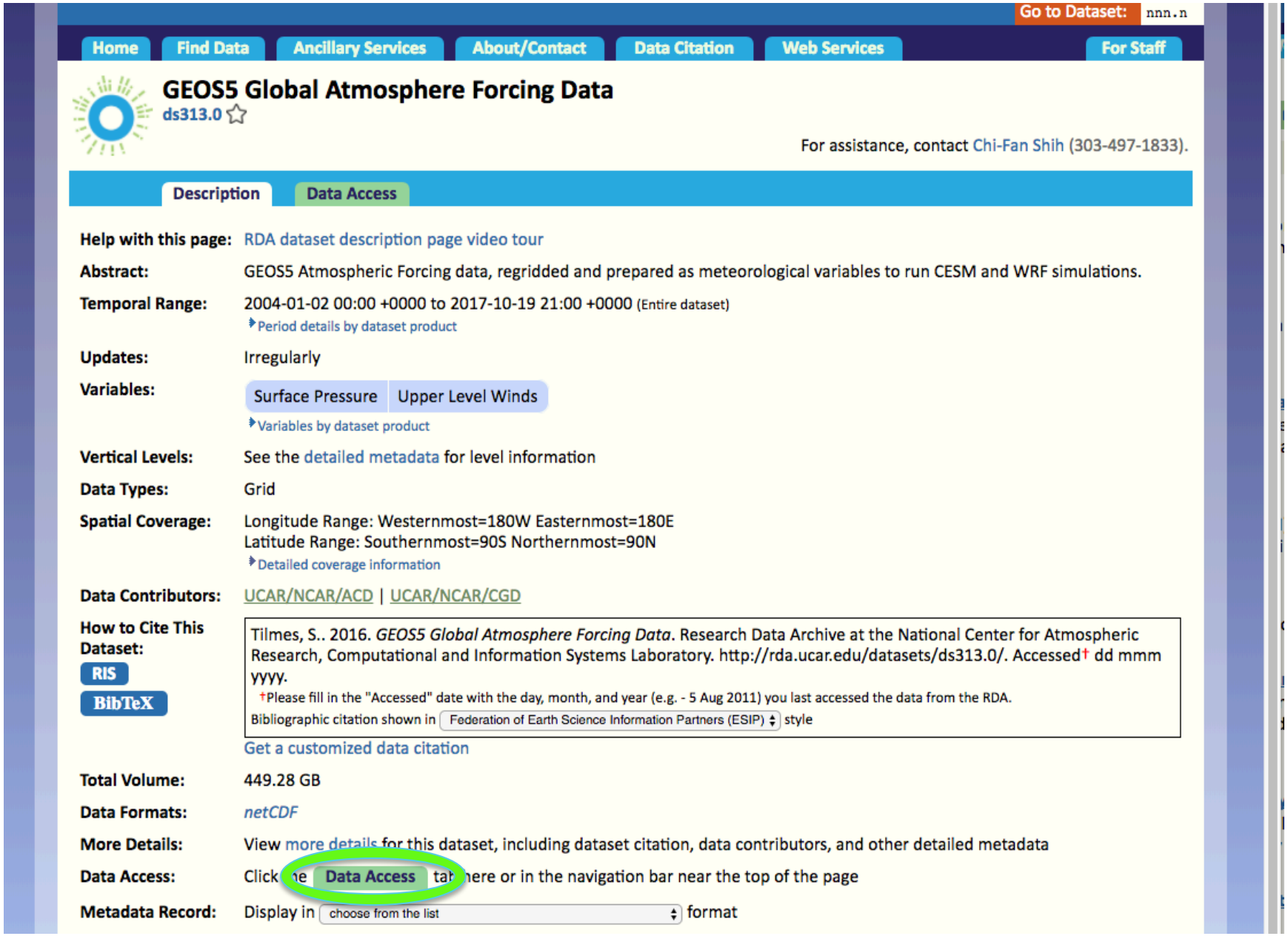
- Data sets (there are many more, but these are two):
- https://rda.ucar.edu/datasets/ds199.1/ (1.5TB)
- https://rda.ucar.edu/datasets/ds313.0/ (430GB)

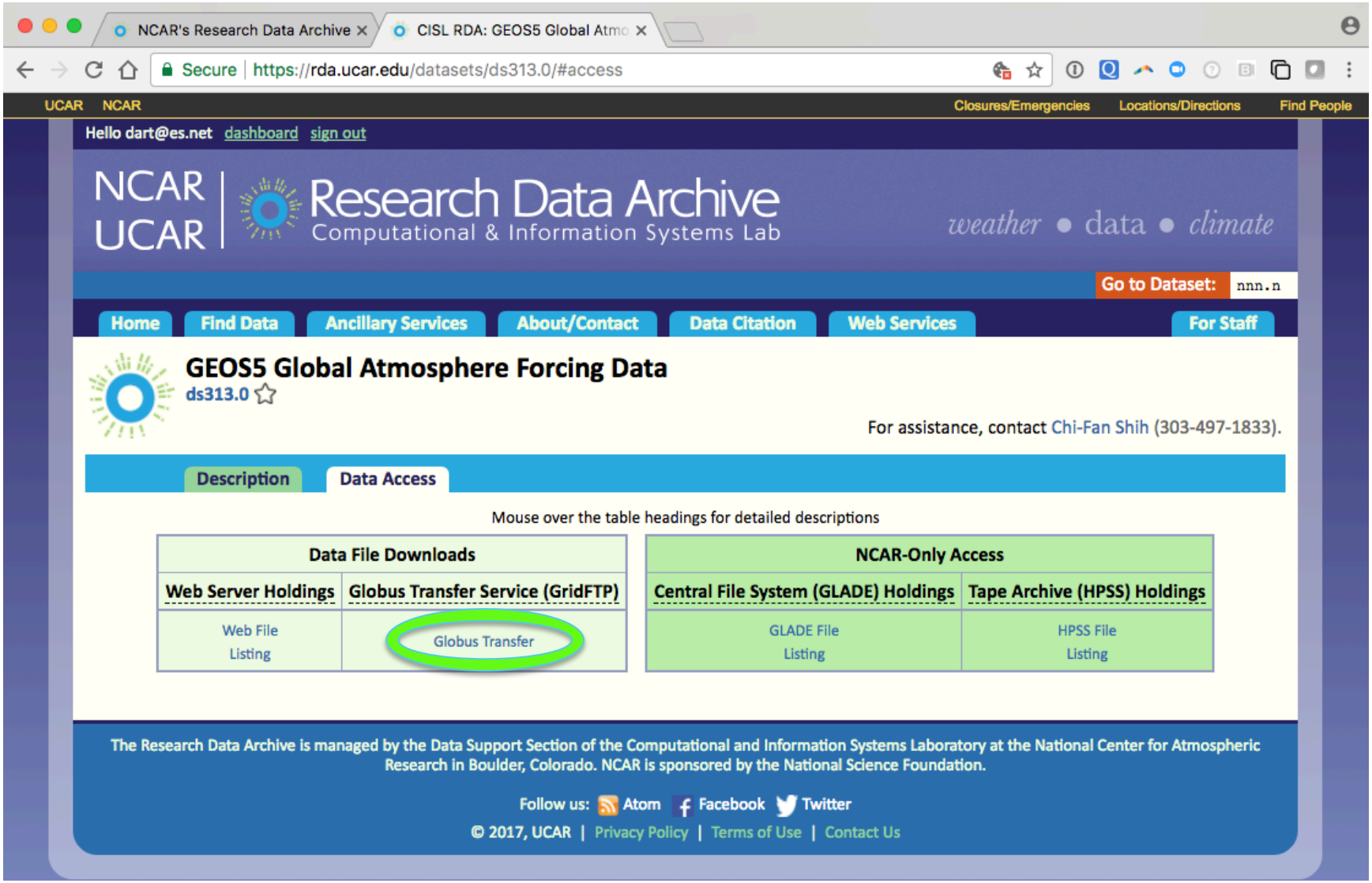
- Download to NERSC (could also do ALCF or NCSA or OLCF)

ESnet

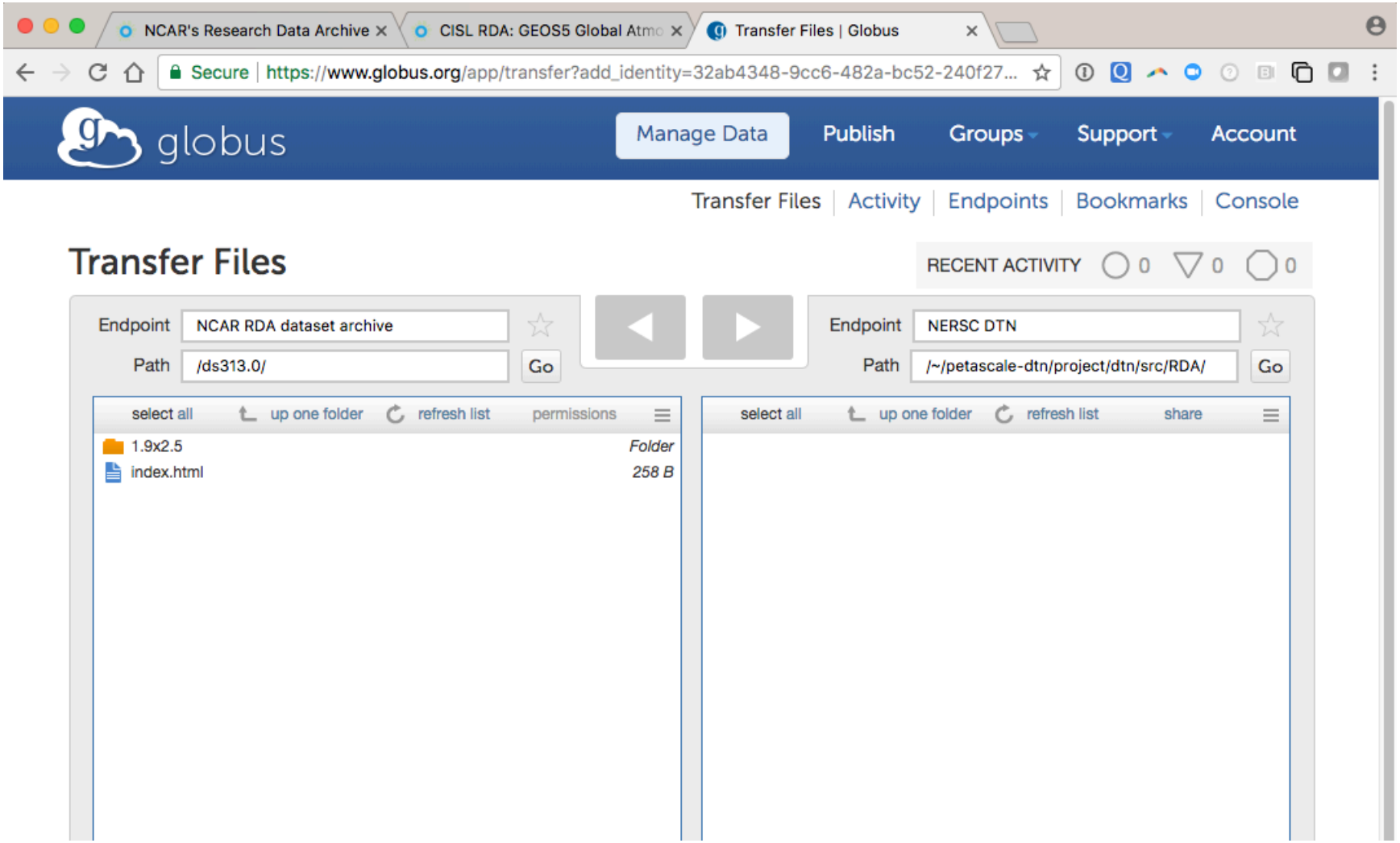

NCAR's Research Data Archive
Secure | https://rda.ucar.edu
UCAR NCAR
Closures/Emergencies
Locations/Directions
Find People
Hello dart@es.net dashboard sign out
NCAR UCAR
Research Data Archive
Computational & Information Systems Lab
weather • data • climate
Go to Dataset: nnn.n
Home
Find Data
Ancillary Services
About/Contact
Data Citation
Web Services
For Staff
First-time visitor to our site?
Please take a video tour of our home page
Dataset Search:
Keyword(s)
Search
Advanced Options
All Datasets
Variable/Parameter
Type of Data
Platform
Spatial Resolution
Topic/Subtopic
Project/Experiment
Supports Project
Data Format
Instrument
Location
Recently Added/Updated
Recently Added Datasets: (within the last 6 months)
ERA5 Reanalysis Monthly Means
Daily Gridded North American Snowfall
ERA5 Reanalysis
NCAR/MOPITT Reanalysis
GridRad - Three-Dimensional Gridded NEXRAD WSR-88D Radar Data
CMIP 5 dataset and code for R parallelization
Dai and Trenberth Global River Flow and Continental Discharge Dataset
Dai Global Palmer Drought Severity Index (PDSI)
Get Help:
Frequently Asked Questions
Reset your password
A-Z Site Index
RDA Users Email List
RDA Blog
RDA video tutorials
Email Us
From Our Blog:
Accessing RDA OPeNDAP endpoints with authentication
All RDA data transfer and processing services restored to production
RDA Service Outage July 14-18, 2017
RDA web services down for maintenance at 1PM MDT on May 3, 2017
More blog posts ...
GLADE Users:
Much of the RDA is directly accessible from


NCAR's Research Data Archive
Secure | https://rda.ucar.edu/#!lfd?nb=y&b=all&v=Full+List
UCAR NCAR
Closures/Emergencies
Locations/Directions
Find People
Hello dart@es.net dashboard sign out
NCAR UCAR
Research Data Archive
Computational & Information Systems Lab
weather • data • climate
Go to Dataset: nnn.n
Home
Find Data
Ancillary Services
About/Contact
Data Citation
Web Services
For Staff
Look For Data:
• Create a New List
-- OR --
Continue Narrowing By:
• Variable / Parameter
• Type of Data
• Time Resolution
• Platform
• Spatial Resolution
• Topic / Subtopic
• Project / Experiment
• Supports Project
• Data Format
• Instrument
• Location
• Progress
• Free Text
Browse the RDA
Showing datasets with these attributes: All RDA Datasets : Full List (680)
Select two datasets and Compare them.
Reset checkboxes
1. Daily Northern Hemisphere Sea Level Pressure Grids, continuing from 1899 (ds010.0)
grids contained in this dataset make up the longest continuous set of daily gridded
pressure data in the DSS archive. These grids have been ...
here Sea-Level Pressure Grids, continuing from 1899 (ds010.1)
continuous time series of monthly gridded Northern Hemisphere sea-level pressure
egree latitude/longitude grids, computed from the daily grids in ...
here Daily Sea-Level Pressure Grids for 1880 to 1979 (ds012.0)
Northern Hemisphere sea-level pressure data on a 10-degree by 5-degree (36x16)
eriod 1880 to 1979.
sphere Daily (and Monthly) Sea-Level Pressure and 500 mb Height Grids for 1946Jan to 1993Dec (ds018.0)
The gridded daily sea-level pressure analyses in this dataset were produced by the operational models of the U.S. Navy Fleet Numerical Oceanography Center (FNOC). The data are arranged in a ...
Type of Data
• Climate_proxy (2)
• Grid (389)
• Log_entry (1)
• Platform_observation (258)
• Radar (2)
• Satellite (38)

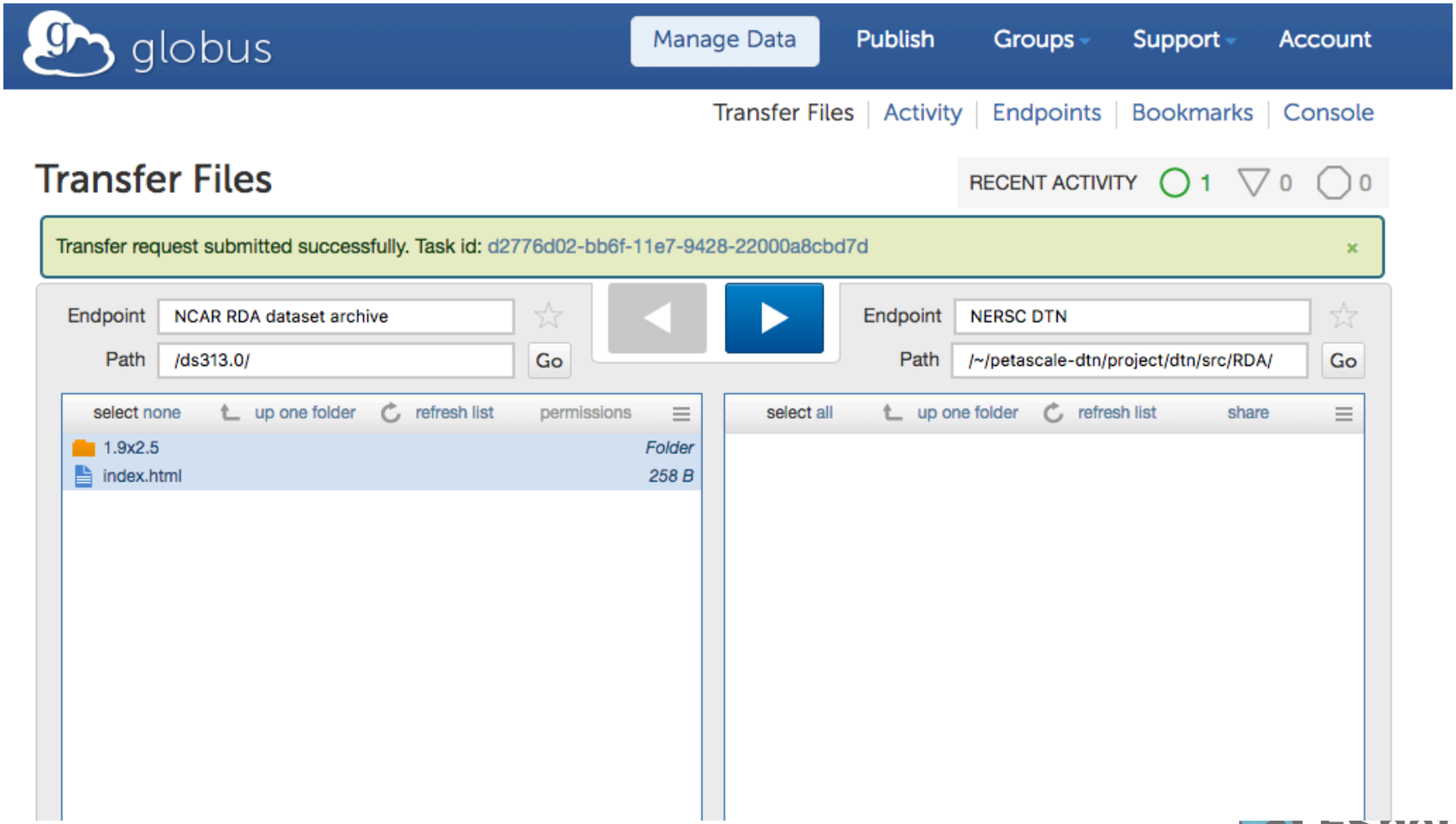

Go to Dataset: nnn.n
Home
Find Data
Ancillary Services
About/Contact
Data Citation
Web Services
For Staff
GEOS5 Global Atmosphere Forcing Data
ds313.0
For assistance, contact Chi-Fan Shih (303-497-1833).
Description
Data Access
Help with this page: RDA dataset description page video tour
Abstract: GEOS5 Atmospheric Forcing data, regridded and prepared as meteorological variables to run CESM and WRF simulations.
Temporal Range: 2004-01-02 00:00 +0000 to 2017-10-19 21:00 +0000 (Entire dataset)
Period details by dataset product
Updates: Irregularly
Variables: Surface Pressure Upper Level Winds
Variables by dataset product
Vertical Levels: See the detailed metadata for level information
Data Types: Grid
Spatial Coverage: Longitude Range: Westernmost=180W Easternmost=180E
Latitude Range: Southernmost=90S Northernmost=90N
Detailed coverage information
Data Contributors: UCAR/NCAR/ACD | UCAR/NCAR/CGD
How to Cite This Dataset:
RIS
BibTeX
Tilmes, S.. 2016. GEOS5 Global Atmosphere Forcing Data. Research Data Archive at the National Center for Atmospheric Research, Computational and Information Systems Laboratory. http://rda.ucar.edu/datasets/ds313.0/. Accessed† dd mmm yyyy.
†Please fill in the "Accessed" date with the day, month, and year (e.g. - 5 Aug 2011) you last accessed the data from the RDA.
Bibliographic citation shown in Federation of Earth Science Information Partners (ESIP) style
Get a customized data citation
Total Volume: 449.28 GB
Data Formats: netCDF
More Details: View more details for this dataset, including dataset citation, data contributors, and other detailed metadata
Data Access: Click the Data Access tab here or in the navigation bar near the top of the page
Metadata Record: Display in choose from the list format


NCAR's Research Data Archive
CISL RDA: GEOS5 Global Atmo
Secure | https://rda.ucar.edu/datasets/ds313.0/#access
UCAR NCAR
Closures/Emergencies
Locations/Directions
Find People
Hello dart@es.net dashboard sign out
NCAR UCAR
Research Data Archive
Computational & Information Systems Lab
weather • data • climate
Go to Dataset: nnn.n
Home
Find Data
Ancillary Services
About/Contact
Data Citation
Web Services
For Staff
GEOS5 Global Atmosphere Forcing Data
ds313.0
For assistance, contact Chi-Fan Shih (303-497-1833).
Description
Data Access
Mouse over the table headings for detailed descriptions
Data File Downloads
Web Server Holdings
Globus Transfer Service (GridFTP)
Web File Listing
Globus Transfer
NCAR-Only Access
Central File System (GLADE) Holdings
Tape Archive (HPSS) Holdings
GLADE File Listing
HPSS File Listing
The Research Data Archive is managed by the Data Support Section of the Computational and Information Systems Laboratory at the National Center for Atmospheric Research in Boulder, Colorado. NCAR is sponsored by the National Science Foundation.
Follow us: Atom Facebook Twitter
© 2017, UCAR | Privacy Policy | Terms of Use | Contact Us

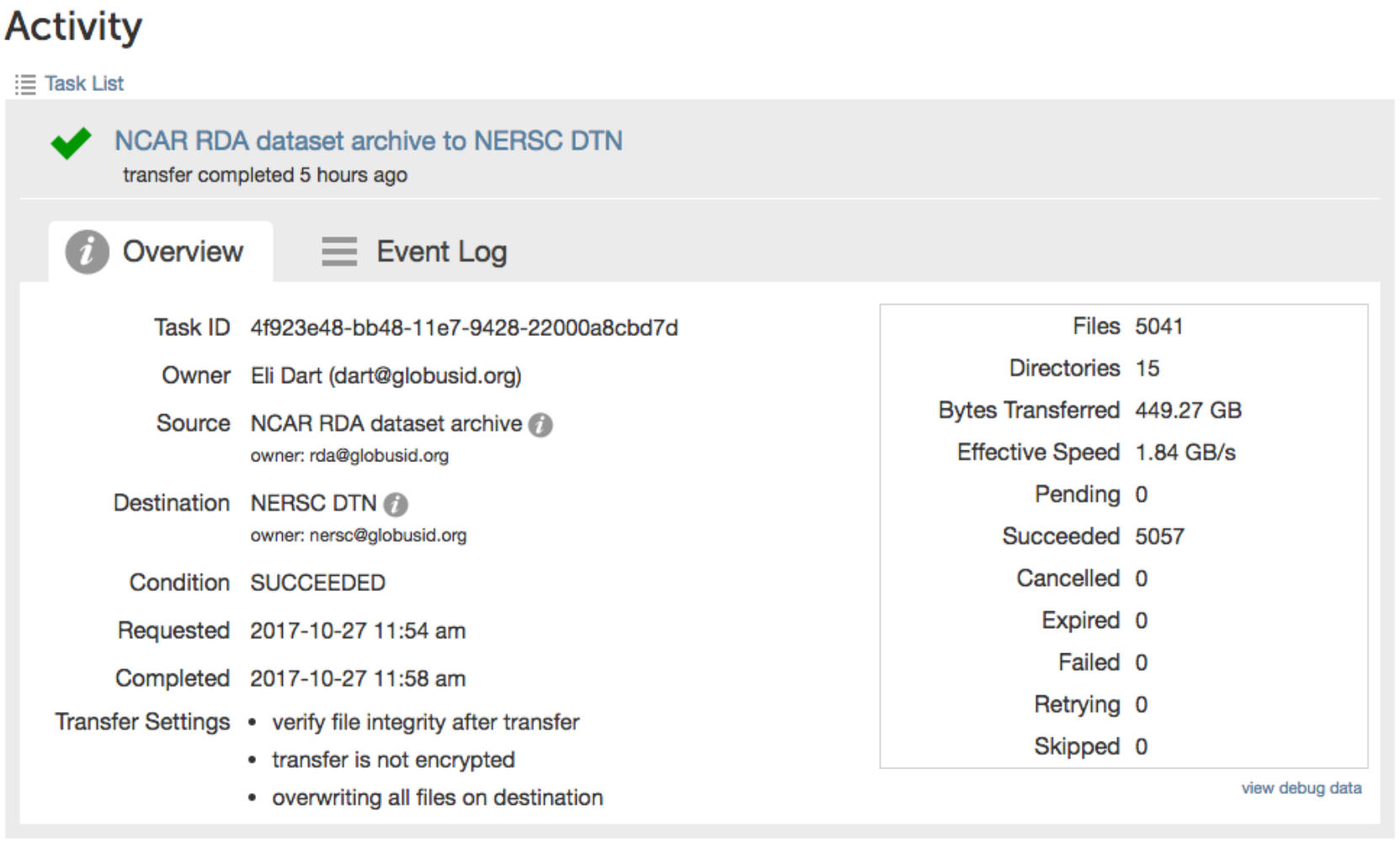
Portal creates a Globus transfer job for us



Submit the transfer job, go about our business



Data Transfer from RDA Portal – Results



What's Possible: The Petascale DTN Project

- Built on top of the Science DMZ model
- Effort to improve data transfer performance between the DOE ASCR HPC facilities at ANL, LBNL, and ORNL, and also NCSA.
  - Multiple current and future science projects need to transfer data between HPC facilities
  - Performance goal is 15 gigabits per second (equivalent to 1PB/week)
  - Realize performance goal for routine Globus transfers without special tuning
- Reference data set is 4.4TB of cosmology simulation data

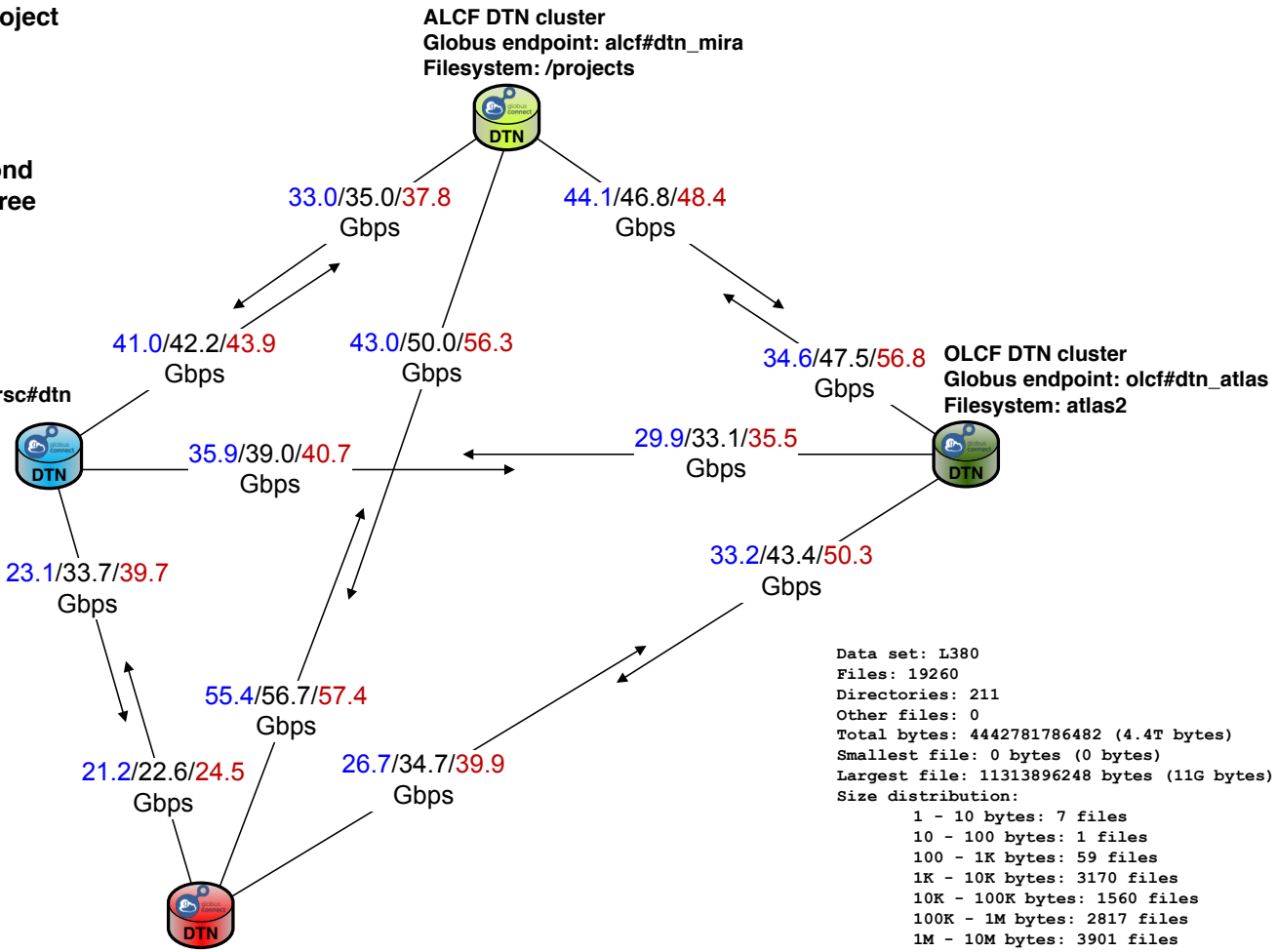
ESnet

DTN Cluster Performance – HPC Facilities

Petascale DTN Project

November 2017
L380 Data Set

Gigabits per second (min/avg/max), three transfers

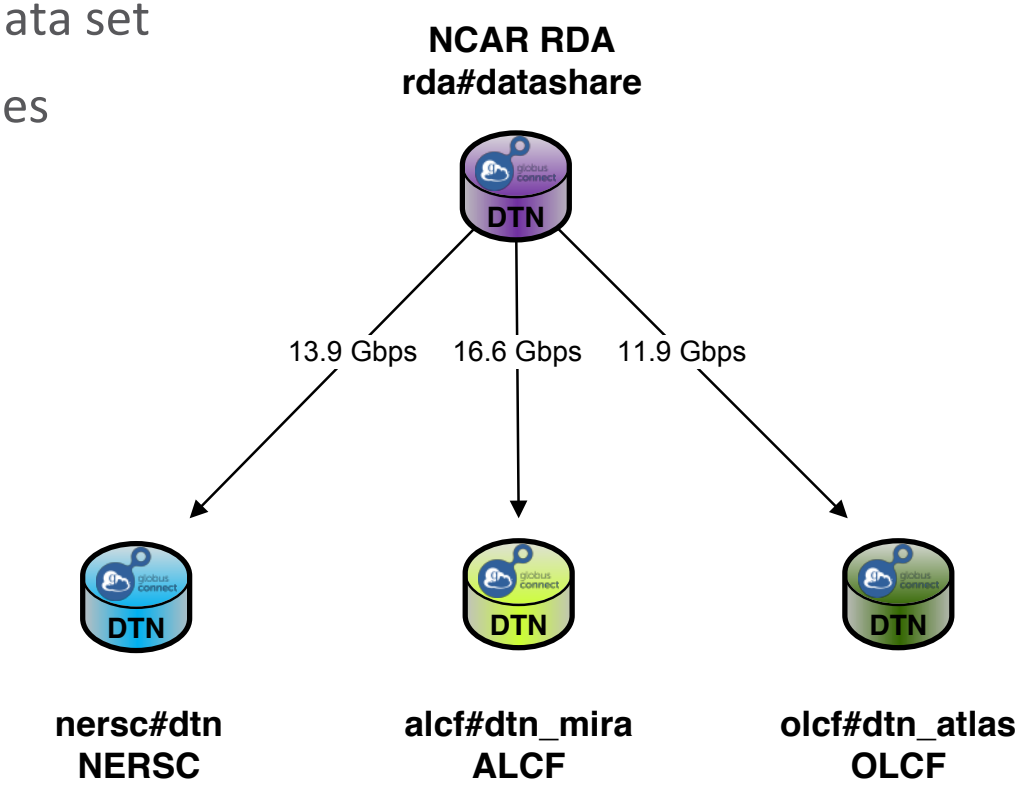



```
Data set: L380
Files: 19260
Directories: 211
Other files: 0
Total bytes: 4442781786482 (4.4T bytes)
Smallest file: 0 bytes (0 bytes)
Largest file: 11313896248 bytes (11G bytes)
Size distribution:
        1 - 10 bytes: 7 files
        10 - 100 bytes: 1 files
        100 - 1K bytes: 59 files
        1K - 10K bytes: 3170 files
        10K - 100K bytes: 1560 files
        100K - 1M bytes: 2817 files
        1M - 10M bytes: 3901 files
        10M - 100M bytes: 3800 files
        100M - 1G bytes: 2295 files
        1G - 10G bytes: 1647 files
        10G - 100G bytes: 3 files
```

ESnet

NCAR RDA Performance to DOE HPC Facilities

- 1.5TB data set
- 1121 files



ESnet

In conclusion – ESnet's vision:

Scientific progress will be **completely unconstrained** by the physical location of instruments, people, computational resources, or data.

ESnet

ESnet

ENERGY SCIENCES NETWORK

Thanks!

Next up: Lukasz Lasinski – Globus

http://my.es.net/

http://www.es.net/

http://fasterdata.es.net/

U.S. DEPARTMENT OF ENERGY

Office of Science

BERKELEY LAB

Globus Connect Server v5

- ESGF uses Globus Connect Server v4 which depends on Globus Toolkit
- Support for Globus Toolkit will end in 2018
- Globus Connect Server v5
  - Single port GridFTP (no ephemeral ports)
  - OAuth2 in GridFTP (no more X.509 user certificates or MyProxy)
  - OpenID Connect identity provider
  - HTTPS access to storage
  - Supports multiple connectors in single installation (POSIX, S3, Google Drive)
  - Distributed as Docker containers
  - Released around mid-year 2018
- Globus GUI, Globus CLI, Globus SDK

ESnet

ESGF

- Globus Connect Server v5 in ESGF
  - globus-url-copy has to be replaced with Globus SDK/CLI
  - IdPs have to move from OpenID to OpenID Connect (OIDC)
    - planned around mid-year 2018
- Data Transfer Nodes (DTNs)
  - Egress DTN
    - Globus Connect Server v4 with the ESGF authorization callout
    - Documented on https://earthsystemcog.org
    - Data sets published with Globus URI (DKRZ, IPSL, JPL, LLNL, NCI, UCAR)
  - Globus Connect Server v5 with the ESGF authorization callout and ESGF OIDC
- Ingress DTN
  - Regular Globus Connect Server v4 or v5
  - Documented on https://docs.globus.org

ESnet

ESnet

ENERGY SCIENCES NETWORK

Thanks!

Next up: Stephan Kindermann - DKRZ

http://my.es.net/

http://www.es.net/

http://fasterdata.es.net/

U.S. DEPARTMENT OF ENERGY

Office of Science

BERKELEY LAB

ESGF Replication

S. Kindermann, ESGF F2F 2017

ESnet

Replication: Discussion Topics

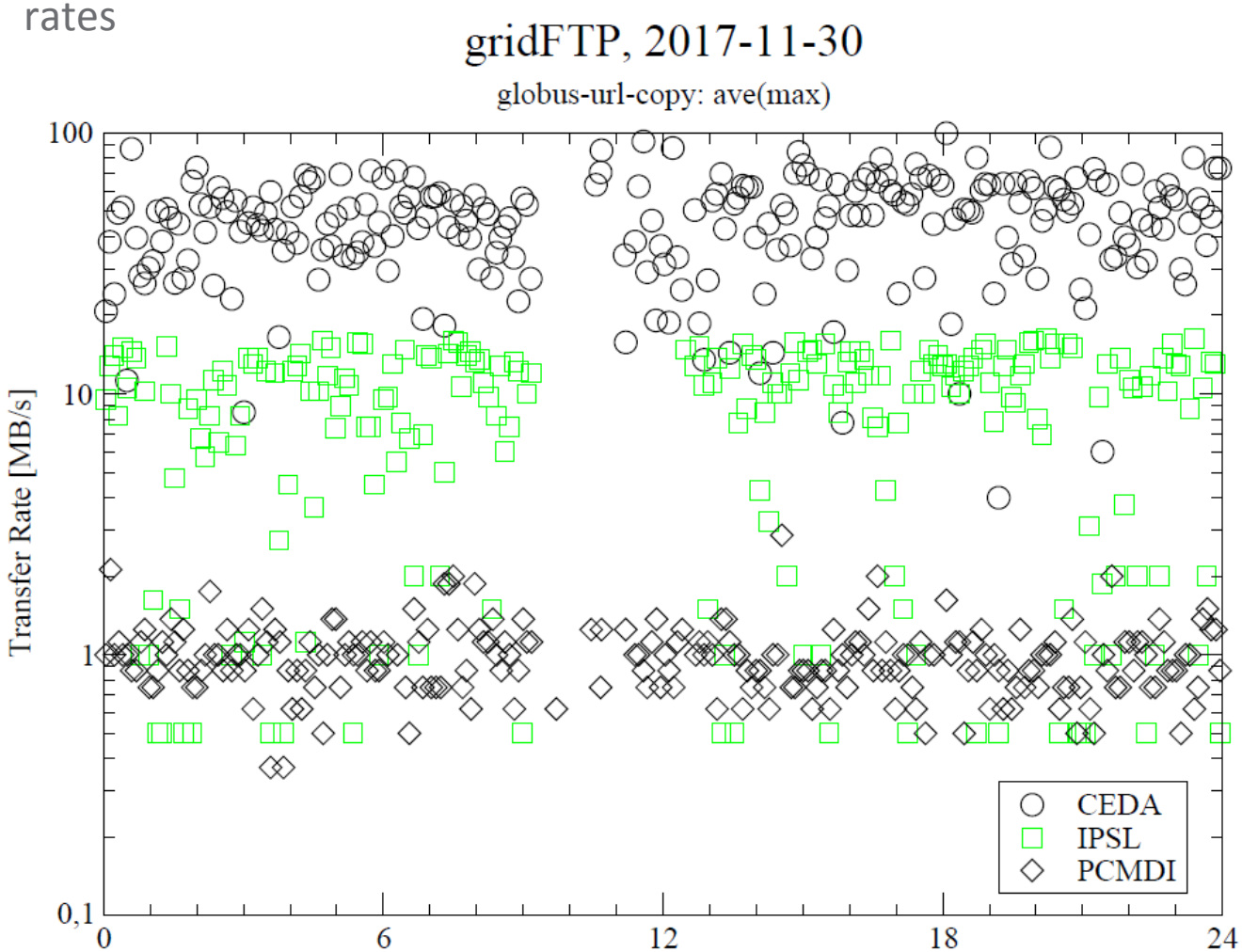
- replication status, problems ..
- Short term action planing to support CMIP6
  - Single stream bandwidth improvments
  - Configuration at sites
  - Data publication and DTNs
- Longer term action planing
  - Globus online exploitation
  - PID exploitation
  - monitoring „dashboard“
  - Full DTN architecture exploitation
  - ..

ESnet

Status

Production deployments slowly stabilize, yet unclear overal picture
e.g. last test before departure to the ESGF meeting:

- DKRZ ←→ CEDA, IPSL, PCMDI (NCI not reachable)
- Looked completely different some weeks before ..
- → besides synda (parallel transfer rates), need to look at single stream transfer rates



Snet

Data hubs and data nodes

Two replication streams to separate

(data hub = larger ESGF replication center)

- data hub ← synda ← data_nodes
- data hub ← synda → data hub
- (dark data hub ← ?? ← data_node, data_hub)

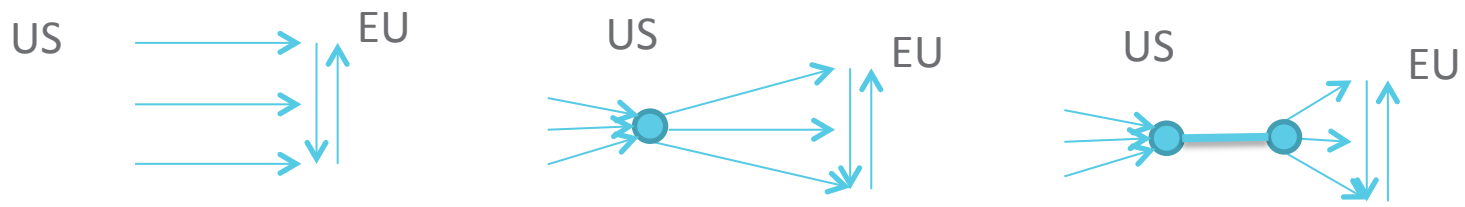
Need to start coordination discussions:

- Hot spots: identification, synchronization
  - Most accessed variables for CMIP5 available, but ..
- Uncoordinated scenario:
  - Data gets published at a data node
  - All data hubs start replicating
- Data priorities at data hubs ?

  Europe:
  - Started IPCC WG1/2 requirements discussion with data hubs at DKRZ and STFC/CEDA
  - Evaluation (ESMVal) needs
  - Explicit wishes from user groups
- How to coordinate ?
  - Min requirement: make priorities at data hubs transparent – synda sel. files on github .. ?

ESnet

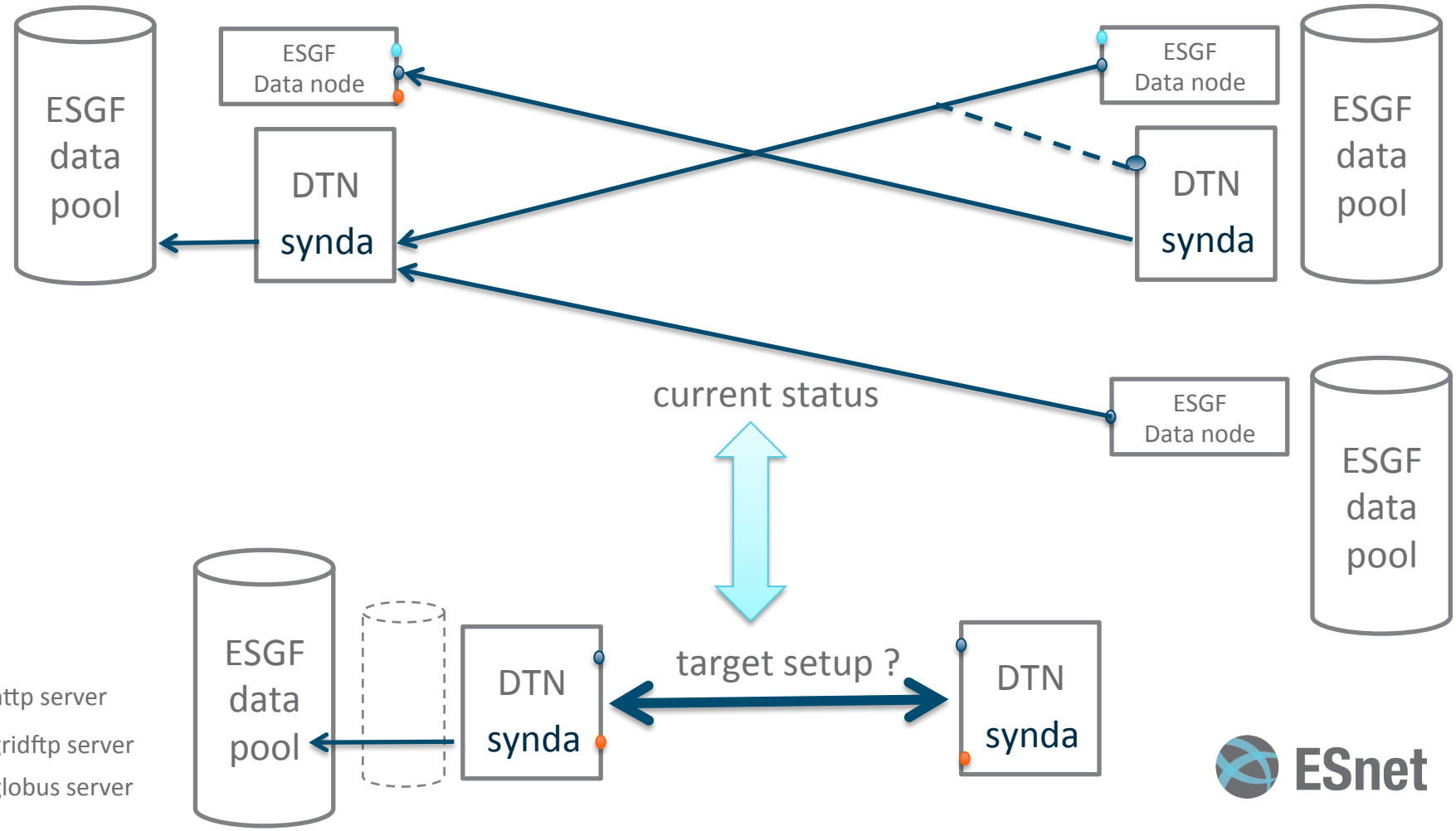
- Ho to coordinate replication ?
  - Publically visible github repos with site specific synda selection files ?, specific datahub repo for coordinated things ?



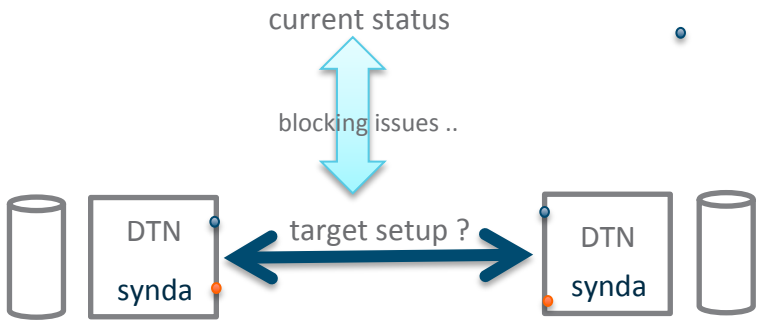
ESnet

Replication: status

Separate gridftp endpoint @ DTN
- Synda config
- endpoint esgf publication

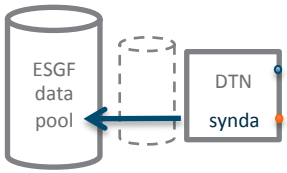


ESnet



Problems / Issues

- Installation / deployment
- DTN „visibility“ in ESGF infra
- DTN / firewall / data pool setup



→ Solution approaches

- „esgf“ gridftp/globus installation package
- Agreements with respect to DTN publication
- Best practice collection ..

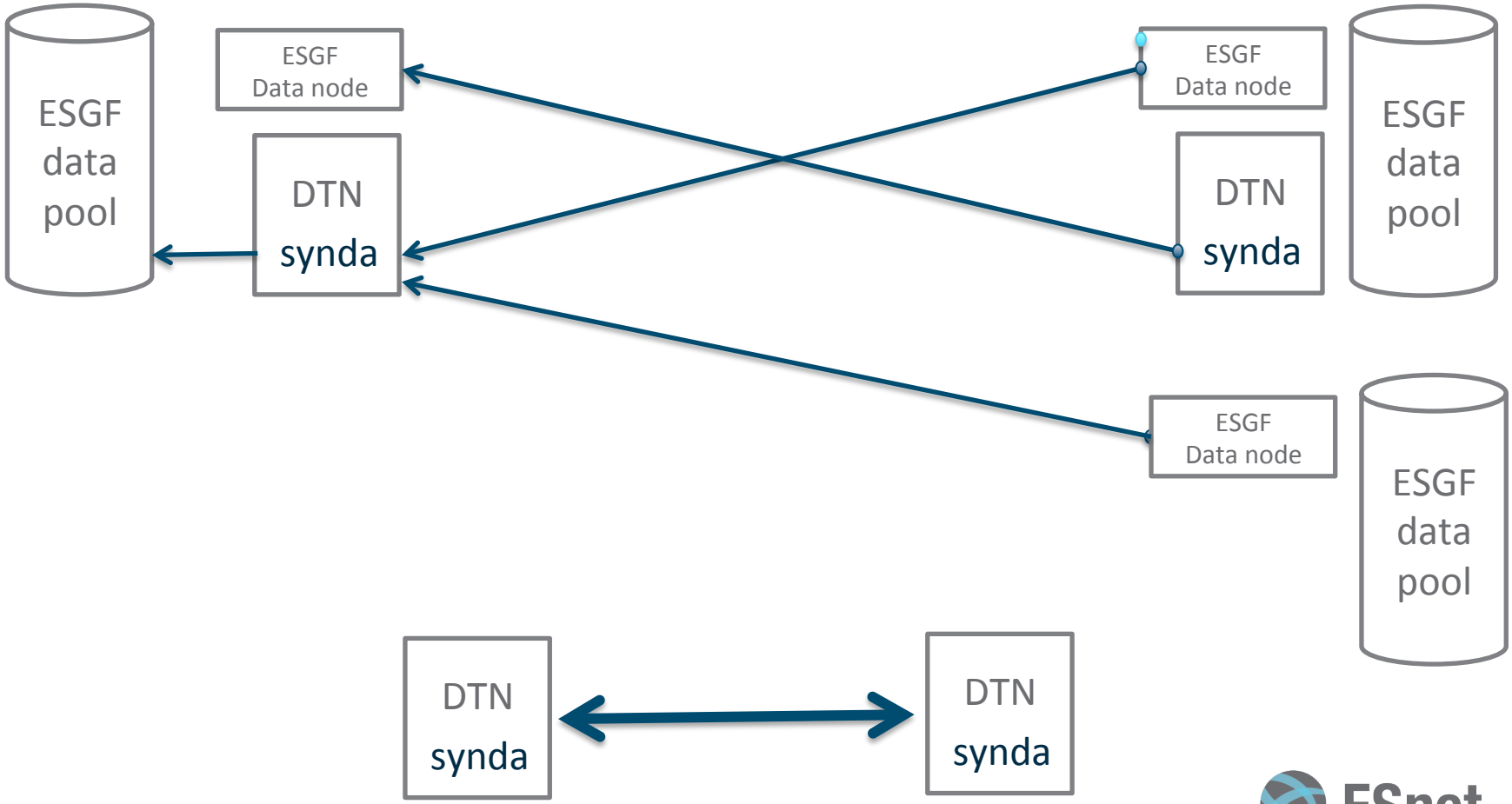
ESnet

- Data publication and DTNs
  - Who will provide separate DTN endpoints for data download (besides ESGF datanode gridftp endpoints) ?

    To Do's:
  - Standard instructions in publisher docu
  - Implement consistent DTN enpoint support in infra (naming, index, cog,..)
  - DTN setup instructions (gridftp + esgf AA callout + certificates + (globus) + ..

ESnet

Replication: setup alternatives



ESnet

ESnet

ENERGY SCIENCES NETWORK

Thanks!

Next up: Questions/Discussion

http://my.es.net/

http://www.es.net/

http://fasterdata.es.net/

U.S. DEPARTMENT OF ENERGY

Office of Science

BERKELEY LAB